Pigment Concentration

Product Description

This set of products provides particle concentrations in Case 1 sea water. Product MOD 19 is total Pigment Concentration (Parameter 2591); Product MOD 23 is Suspended-Solids (Parameter 3085); Product MOD 24 is Organic Matter Concentration in two parameters, Particulate (2608) and Dissolved (2580); and Product 26 gives Ocean Water Attenuation Coefficient at two wavelengths, 490 nm (Parameter 3199) and 530 nm (Parameter 3206). The products are available at Level 2 daily and at Level 3 daily and weekly. Both levels are produced at 1 km and 20 km.

Research & Applications

This set of ocean substance concentrations is needed for input to the ocean productivity algorithm which is a key element in global biogeochemical models and ultimately global climate models. The pigment parameter is the sum of the chlorophyll *a* and phaeopigment concentration in Case 1 waters. Case 1 waters have optical properties which are dominated by chlorophyll and associated covarying detrital pigments. (Case 2 waters contain substances which affect optical properties which may not covary with chlorophyll such as gelbstoff, suspended sediments, cocolithophores, detritus, and bacteria.) The suspended-solids parameter is a measure of ocean suspended sediments which is used in the analysis of complex bio-optical properties of coastal and estuarine regions/environments and helps to map the extent of terrestrial changes. The organic matter concentration relates to the composite of carbon and nitrogen substances. The ocean water attenuation coefficient is derived using MODIS bands 10 and 11 and describes penetration of sunlight in the sea.

Data Set Evolution

The algorithm is based primarily on methods and algorithms developed for the CZCS program described by Gordon and Clark (1980) and refined and adapted to the MODIS bands. The recasting of the CZCS forms of the phytoplankton pigment algorithms in terms which are more representative for MODIS has resulted in minor changes. Particularly significant is that the multiple band ratios will provide a robustness not possible with the CZCS's limited spectral coverage.

Suggested Reading

Gordon, H.R. and D.K. Clark, 1980.

Gordon, H.R., *et al.*, 1980.

Gordon, H.R., and A.Y. Morel, 1983.

Lorenzen, C.J., and S.W. Jeffrey, 1980.

Smith, R.C. and K.S. Baker, 1977.

MOD 19, MOD 23, MOD 24, MOD 26 PRODUCT SUMMARY

Coverage:
global ocean surface, clear-sky only

Spatial/Temporal Characteristics:
1 km/daily, weekly

Key Science Applications:
ocean productivity, biogeochemical models

Key Geophysical Parameters:
total ocean pigment, suspended solids, organic matter concentration, attenuation coefficient

Processing Level:
2, 3

Product Type:
standard, at-launch

Science Team Contact:
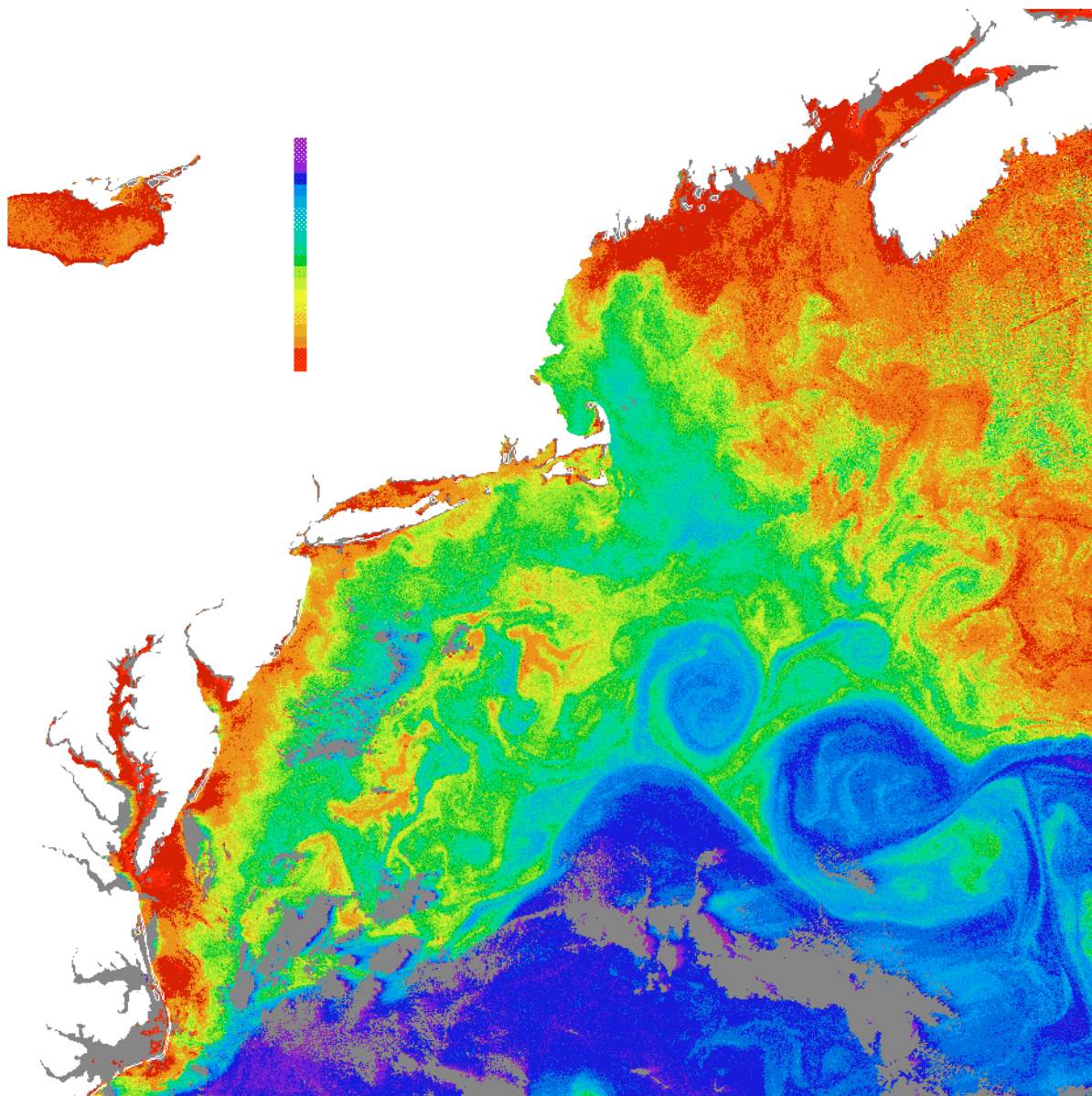D. Clark

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Pigment Concentration

Figure 37. **East Coast Ocean Color Image.** A daily Coastal Zone Color Scanner product for the northeastern coast of the United States reveals the high pigment concentrations along the coast and the influence of the Gulf Stream. Phytoplankton concentrations, and additional ocean carbon system parameters from MODIS, will be much more accurate than was possible with the CZCS because of improvements in spectral bands, calibration, and algorithms. *NASA, GSFC*

Pigment Concentration

Product Description

This Level 2 product contains several parameters describing ocean chlorophyll fluorescence properties. Fluorescence line height (Parameter 2575) is a relative measure of the amount of radiance leaving the sea surface at the fluorescence wavelength of 683 nm. Parameter 3211 is Fluorescence Efficiency which provides a relative measure of the absorption of PAR and its emission as chlorophyll fluorescence. The third is Fluorescence Line Curvature (Parameter 2573). The spatial resolution will be 1 km for chlorophyll levels greater than 1.5 mg/m^3 and 5×5 km for values less than 1.5. The Level 2 product is produced daily and Level 3 is gridded and produced daily and weekly.

Research & Applications

Solar stimulated chlorophyll fluorescence is a measure of the current photophysology of phytoplankton, in contrast to the biomass estimate provided by chlorophyll. The product quantifies the level of photosynthesis by phytoplankton in the ocean. Historically, the coupling between fluorescence and chlorophyll has been studied extensively and recent research has focused on the use of Sun-stimulated fluorescence to estimate primary productivity (Kiefer and Reynolds, 1992). Basic fluorometric measurements are made using an instrument described by Holm-Hansen *et al.* (1965) which uses blue light stimulation and this method has been used unchanged for 30 years. Gower (1990) was among the first to attempt using Sun-stimulated radiance at 683 nm to estimate chlorophyll concentrations from aircraft and satellites.

Data Set Evolution

Inputs to the algorithm are Chlorophyll Concentration (MOD 19), Absorbed Radiation by Phytoplankton (MOD 22), and Water-Leaving Radiance (MOD 18). Water-leaving radiance for MODIS bands 13 (667 nm), 14 (678 nm) and 15 (748 nm) are used in the algorithm. The algorithm is applied to the daily input standard product datasets and is remapped into standard Level 3 grids. The validation approach will be to compare the fluorescence line height result with other MODIS

data products (e.g. Chlorophyll *a*, comparison with surface measurements and comparison of MODIS fluorescence products with other satellite-based estimates of the same products). The products are produced only for non-cloud, glint-free ocean pixels during daylight hours.

Suggested Reading

Abbott, M.R., *et al.*, 1982.

Chamberlin, W.S. and J. Marra, 1992.

Gower, F.J.R. and G.A. Borstad, 1990.

Holm-Hansen, O., *et al.*, 1965.

Kiefer, D.A. and R.A. Reynolds, 1992.

Topliss, B.J., and T. Platt, 1986.

**MOD 20
PRODUCT SUMMARY**

Coverage:
global ocean surface, clear-sky only

Spatial/Temporal Characteristics:
1 km for chlorophyll levels greater than 2.0 mg/m^3/daily, weekly

Key Science Applications:
ocean chlorophyll, ocean productivity

Key Geophysical Parameters:
chlorophyll fluorescence

Processing Level:
2

Product Type:
standard, at-launch

Science Team Contact:
M. Abbott